CLAIMS

[1] A magnetic bearing device, characterized in that the magnetic bearing device comprises:

a rotor;

a plurality of electromagnets for controlling a radial position and/or an axial position of the rotor;

a power source for supplying power to the electromagnets;

a common node commonly connected to each one end of the electromagnets;

switch means for switching a voltage of the common node; and

excitation control means for controlling excitation of each of the electromagnets by a supply current supplied from the other end of one of the electromagnets to a negative electrode of the power source, or by a regenerated current regenerated from the other end of one of the electromagnets to a positive electrode of the power source, and in that:

the switch means includes:

a first switch element for connecting and disconnecting between the positive electrode and the common node; and

a first rectifier element for causing a current to flow from the negative electrode to the common node; and

the excitation control means includes:

a second switch element for connecting and disconnecting between the other end of one of the electromagnets and the negative electrode; and

a second rectifier element for causing a current to flow from the other end of one of the electromagnets to the positive electrode.

[2] A magnetic bearing device, characterized in that the magnetic bearing device comprises:

a rotor;

a plurality of electromagnets for controlling a radial position and/or an axial position of the rotor;

a power source for supplying power to the electromagnets;

a common node commonly connected to each one end of the electromagnets;

switch means for switching a voltage of the common node; and

excitation control means for controlling excitation of each of the electromagnets by a supply current supplied from a positive electrode of the power source to the other end of one of the electromagnets, or by a regenerated current regenerated from a negative electrode of the power source to the other end of one of the electromagnets, and in that:

the switch means includes:

a first switch element for connecting and disconnecting between the common node and the negative electrode; and

a first rectifier element for causing a current to flow from the common node to the positive electrode; and

the excitation control means includes:

a second switch element for connecting and disconnecting between the positive electrode and the other end of one of the electromagnets; and

a second rectifier element for causing a current to flow from the negative electrode to the other end of one of the electromagnets.

[3] The magnetic bearing device according to claim 1 or 2, characterized in that the current caused to flow through each of the electromagnets is increased, decreased, or maintained to be constant by adjusting a switching phase of the switch means and a control phase of the excitation control means within a common control cycle.

[4] The magnetic bearing device according to any one of claims 1 to 3, characterized in that the first rectifier element includes a third switch element connected in parallel therewith.

[5] A magnetic bearing device, characterized in that the magnetic bearing device comprises:

a rotor;

a plurality of electromagnets for controlling a radial position and/or an axial position of the rotor;

a power source for supplying power to the electromagnets;

a common node commonly connected to each one end of the electromagnets;

switch means for switching a voltage of the common node;

a first excitation control means for controlling excitation of at least one of the plurality of electromagnets by a supply current supplied from the other end of one of the electromagnets to a negative electrode of the power source, or by a regenerated current regenerated from the other end of one of the electromagnets to a positive electrode of the power source; and

a second excitation control means for controlling excitation of electromagnets other than the at least one electromagnet

controlled through excitation by the first excitation control means, by a supply current supplied from the positive electrode to the other end of another one of the electromagnets, or by a regenerated current regenerated from the negative electrode to the other end of the another one of the electromagnets, and in that:

the switch means includes:

a switch element for connecting and disconnecting between the common node and the negative electrode, and a switch element for connecting and disconnecting between the positive electrode and the common node; and

a rectifier element for causing a current to flow from the common node to the positive electrode, and causing a current to flow from the negative electrode to the common node, respectively;

the first excitation control means includes:

a switch element for connecting and disconnecting between the other end of one of the electromagnets and the negative electrode; and

a rectifier element for causing a current to flow from the other end of the one of the electromagnets to the positive electrode; and

the second excitation control means includes:

a switch element for connecting and disconnecting between the positive electrode and the other end of another one of the electromagnets; and

a rectifier element for causing a current from the negative electrode to the other end of the another one of the electromagnets.

[6] The magnetic bearing device according to claim 5,

characterized in that the current caused to flow through each of the electromagnets is increased, decreased, or maintained to be constant by adjusting a switching phase of the switch means and control phases of the first excitation control means and the second excitation control means within a common control cycle.

[7] The magnetic bearing device according to claim 5 or 6, characterized in that the plurality of electromagnets are constituted by being divided into two groups, one controlled by the first excitation control means and the other controlled by the second excitation control means so that the current caused to flow between the positive electrode and the common node and the current caused to flow between the common node and the negative electrode are made substantially equalized.

[8] The magnetic bearing device according to any one of claims 1 to 7, characterized by further comprising current detecting means for detecting a value of the current when a constant current is caused to flow through the electromagnets.

[9] The magnetic bearing device according to claim 8, characterized in that the current detecting means includes a resistance having one end connected to the negative electrode, and a detection portion for detecting a current flowing through the resistance.

[10] A turbo molecular pump comprising the magnetic bearing device according to any one of claims 1 to 9 mounted thereto, characterized in that:

the rotor has rotary vanes and a rotor shaft placed at the center of the rotary vanes; and

each of the electromagnets levitates the rotor shaft by a magnetic force.

[11] The turbo molecular pump according to claim 10, characterized in that the turbo molecular pump comprises:

a turbo molecular pump main body having the rotor and the electromagnets; and

a control device having the switch means and the excitation control means, or the switch means, the first excitation control means, and the second excitation control means, and

in that the turbo molecular pump main body and the control device are integrated into one.